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COCOM Document 3483

April 8, 1959

MEMORANDUM FROM THE

UNITED STATES DELEGATION

CONCERNING

THE STRATEGIC SIGNIFICANCE OF STAR QUAD COMMUNICATIONS CABLE

(Item 1526)

References: COCOM Documents 3464, 3472

1. The United States Delegation believes that the discussion thus far of the communications cable under examination by the Committee has not fully elucidated its great strategic importance and has sometimes been too technical. The United States Delegation, therefore, wishes to present in as non-technical terms, as possible, a resumé of the reasons why the characteristics of this cable make its denial to the Soviet Bloc mandatory.

2. The cable desired by the Soviet Union has certain basic characteristics. It is composed of about 14 star quads (explained below) with a diameter for the most part of 1.2 mm. The cable has a mutual capitance of .026 microfarads (the same as 26 nanofarads) per kilometer. It is sheathed in lead or aluminum and shielded to keep induced voltage to a factor of 0.1. It is sometimes armored with steel bands. In total, about 6000 kilometers of cable are being sought by the Soviet Union. There are other minor features of the cable, including the 5 signal wires, but the foregoing are the fundamental and determining ones. In order to understand why the cable is strategic these characteristics must first be understood.

3. The term "star quad" or sometimes "spiral four" is the key to identifying this cable as designed for modern communications needs. A quad means four wires or conductors grouped together. A "star quad" means four wires physically arranged in a square and twisted in a very precise way to provide special electrical characteristics not possible in four wires laid flat or otherwise grouped in a cable. The Soviet cable is about 14 star quad which is 28 pairs or 56 single wires.

4. Mutual capacitance is one of the factors determined by the foregoing "star quad" arrangement. This is an electrical characteristic in communications cable which basically affects how many channels of communication can be squeezed on the four wires.

5. The diameter of wire in cable generally determines how far apart amplifying units must be placed. That is, the larger the wire diameter, the further apart these stations can be placed and, therefore, the fewer amplifiers are needed. Thus, where the distance to be covered is great and the areas to be crossed are remote, the wire should be relatively large. A diameter of 1.2 mm is considered a good size for long distances.

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6. Sheathing is the outer covering of the cable. It protects the wires inside from moisture, dirt and damage by insects, animals etc. It is used on all outdoor and much indoor cable. Lead or lead alloys are a standard sheathing material because they are flexible, do not rust and are easily joined.

7. Shielding is an electrical protection for the wires to prevent the interference of other electrical forces such as those from parallel electric power lines (including electrified railroads), from electrical storms, nearby electrical installations and magnetic disturbances associated with the aurora borealis. It can be accomplished with aluminum foil, external steel armoring or other materials. Shielding, too, is common practice throughout the world for all types of communications cable. How heavy the shielding must be depends on the outside interference expected and the clarity desired in the communications in the cable. The Soviet specification that induced voltage shall be kept to a factor of 0.1 (paragraph 2) suggests that the cable is to be shielded against interference from an electrical installation and that the communication is to be of high fidelity.

8. Armoring is physical protection to save the delicate wires in the cable from damage by crushing or cutting. Usually it is a tough spiral steel band wound around the cable which also provides shielding against undesired electrical interference. It is a normal means of protecting any outdoor cable laid directly in or on the surface of the earth.

9. It is the foregoing characteristics of a cable alone which can be determined in its manufacture. While these characteristics disclose relatively little about how the cable will be used, they do reveal a great deal about how the cable can be used. The following explanation will illustrate how cable with specifications similar to those of the cable requested by the Soviets, can be used.

10. The USSR has indicated that some of this cable is to be "loaded" or "charged". Loading is a simple means of extending the distance over which a telephone conversation can be carried by wires. It consists simply of carefully wound bobbins of wire which are connected to the cable at regular intervals, usually about 1.7 kilometers. These bobbins are added to the cable when it is installed and are simply external attachments. It is impossible to know from studying a piece of cable whether or not loading will be used. (When cable is loaded it can accommodate far fewer channels of communication than when used with the modern electronic devices described below.) The Soviet claim that the cable is to be loaded cannot be verified until the cable is installed. Others can determine, however, how the cable is capable of being used.

11. To begin with, the cable desired by the Soviets meets the standards established for communications cable by the International Telephone and Telegraph Consultative Committee (CCITT), a body of the International Telecommunication Union. This international organization has agreed upon standards for communications in order to standardize and improve the technical quality of European telephone, telegraph, radio and television practices. In Volume IIIbis of the XVIIIth Plenary Assembly, Geneva, 3-14 December 1956, of the International Telephone Consultative Committee (CCIF), page 93, the following specifications are given for multichannel communications cable - Type II: Diameter 1.2 mm; effective capacitance per kilometer, .0265 microfarads. This is identical with the Soviet specifications. (The absence of mention of shielding, sheathing and armoring is not relevant. These features are added to cable depending on the environment in which the cable is to be laid.)

12. Cable of such carefully engineered characteristics can be used in many ways. Normally cable of this degree of refinement is not used with loading which works just as well on less complicated cable. However, star quad can be used with loading and it can then carry about 1½ long distance telephone channels for each quad. Thus, if all of the 14 star quad in the Soviet cable were loaded, it could accommodate about 21 long distance telephone channels.

13. More modern practice, however, is to use "carrier" equipment with this cable. (Carrier is an electronic system used for many years which permits many channels to be squeezed on the same star quad. Normal types cannot be used on ordinary quad cable and none can be used on a cable equipped with loading.) In fact, this cable is specifically engineered for carrier use as indicated in the CCITT specifications and in manufacturers catalogues, such as that issued by Standard Telephones and Cables Limited, London. With relatively modern carrier systems, available throughout the world, it is possible to put at least 12 telephone channels on each star quad. This is a conservative figure. Many systems used in Europe today get 12 to 60 telephone channels on each star quad. If the Soviet cable were entirely devoted to telephone carrier, it could accommodate a minimum of 168 telephone channels (12 telephone channels x 14 star quads = 168).

14. It is common modern practice, however, to use additional equipment to transmit much more communications traffic on star quad that is possible in a simple telephone conversation. In the past teleprinter (teletype) has been widely employed to further increase the capacity of cable to transmit messages. If teleprinter is used, it can be substituted for telephone channels at a ratio of 12 to 18 teleprinter channels for each telephone channel. Thus, if the Soviet cable were entirely devoted to teleprinter it could accommodate more than 2,000 simultaneous two-way 60 word per minute teletype channels. (12 telephone channels x 12 teleprinter channels x 14 star quad).

15. The exact relationship of telephone channels to teleprinter channels cannot, of course, be determined by anyone but the Soviet Union when it installs the cable. In this connection, it should be pointed out that the cable in question can readily be laid double or even triple and quadruple in the same operation. Doubling a cable at the time of installation is, in fact, standard engineering practice and somewhat more than doubles the number of channels of communication.

16. Even without proceeding further in examining the communications potential of the cable desired by the USSR, it is evident that it is capable of handling more communications traffic than the Trans-Siberian railroad alone could possible generate.

17. There is, however, another dimension to the capacity of this cable to which the United States alluded in paragraph 3 of its Memorandum on March 23, (COCOM Document 3472) and in paragraph 4 of its Memorandum of March 18 (COCOM Document 3464) but which has apparently not been clearly understood. Further information on this point follows.

18. In its earlier Memoranda the United States Delegation said that the Soviets could be expected to use this cable for their early warning system and for digital transmission. These allusions were significant and intended to convey the serious concern felt by the United States about the intended use of the cable.

19. An early warning system is a network of devices designed: 1) to provide instantaneous warning of the approach of enemy missiles or aircraft and 2) to direct countermeasures. In this era of supersonic aircraft and missiles such a

system must be on the most distant frontiers to give warning in time for counter measures to be taken. Early warning is the sine qua non of survival in modern supersonic nuclear warefare.

20. An early warning system consists, generally speaking, of many radar observation posts which cover every inch of frontier. These radar posts are all joined by radio or cable so that they can send to analysis centers the flood of information they gather twenty-four hours of every day. The system must also include similar communications channels to direct counter measures: the launching of missiles, the despatch of retaliatory bombers or interceptor aircraft and missiles. Knowledge of attack and orders for counter measures must be transmitted in literally seconds across entire continents. Both the information needed to analyze an attack and the orders for counter measures are infinitely complex and large in volume. It is here that the volume capacity and speed of information processing of digital transmission becomes crucial.

21. In recent years techniques have been developed in the non-Communist world and in the USSR as well, permitting an enormous increase in the amount of information or volume of communications traffic which can be transmitted over a single telephone channel. The details of these techniques are highly classified security information although they are in normal military use on a large scale. However, it is generally known that with digital systems vast quantities of information of any kind, whether relating to railroad operation, the course of enemy aircraft or other messages can be electronically compressed and transmitted in pulses measured in thousands of a second. Presently used digital transmission systems can, conservatively, handle roughly twice as much traffic as teleprinters. The resulting communications traffic capacity of a single channel on cable or radio is vastly superior to the methods previously used and now commonly used in PTT services.

22. All of the foregoing facts have a direct bearing on the Soviet efforts to secure communications cable. Assuming that a part of the cable is used for railroad operation, as claimed, there will remain a number of star quads which can be used for the Soviet early warning system and other military communications. In fact, it would appear reasonable to assume that the greater part of the cable is intended to be used for non-railroad communications traffic. Assuming that the Soviets use modern techniques, even a few channels would be adequate to carry an enormous volume of military communications traffic.

23. Cable plays a crucial role in this highly complex system. Since cable can be buried and shielded against external electrical influences - either natural or in the form of various types of artificial interference designed to sabotage electrical communications - it is a safe means of carrying the critical information conveyed in an early warning system at the instant of enemy attack. This is a vital feature of any early warning system which must be totally reliable under the most adverse conditions. The cable sought by the Soviets conforms precisely in its essentials to cable used by the United States and NATO for their own early warning systems.

24. In conclusion, it may be taken as axiomtic that the communications capacity of any cable depends not only on the number of conductors but on the engineering of the cable and on the way it is used. The United States assumes that the Soviet Union will use this cable in at least as efficient a way as do COCOM members.

25. The United States Delegation believes that these considerations alone, aside from those previously submitted to the Committee by the United States Delegation, demonstrate conclusively the strategic nature of the cable in question. The United States Delegation reiterates the view of its Government that no member government should permit the exportation of this type of highly strategic cable to the Soviet bloc.